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CORNELL-DUBILIER ELECTRONICS SUPERFUND SITE SOUTH PLAINFIELD, NEW JERSEY

OPERABLE UNIT 4: BOUND BROOK

QAPP APPENDIX A:

FINAL FIELD SAMPLING PLAN

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1. PROJECT DESCRIPTION

1.1. Introduction

This Field Sampling Plan (FSP) describes the procedures that will be used to collect data in support of the Remedial Investigation (RI) at Operable Unit 4 (OU4) of the Cornell-Dubilier Electronics (CDE) Superfund Site (Site) located in South Plainfield, Middlesex County, New Jersey. The purpose of the FSP is to ensure that samples are properly collected, handled, and transported to the laboratory, and that sample collection and handling procedures are fully documented.

Compliance with the FSP will yield the collection of representative samples, minimize the potential for cross-contamination, and ensure both proper preservation of the samples and laboratory analysis of appropriate constituents. The sampling and data collection methods described in this FSP are consistent with U.S. Environmental Protection Agency (USEPA), U.S. Army Corps of Engineers (USACE), and New Jersey Department of Environmental Protection (NJDEP) guidance documents, including:

- A Compendium of Superfund Field Operations Methods (USEPA, 1987). Region II CERCLA Quality Assurance Manual (USEPA, 1989).
- Contract Laboratory Program Guidance for Field Samplers, EPA-540-R-04-003 (USEPA, 2007).
- Requirements for the Preparation of Sampling and Analysis Plans (USACE, 2001).
- Field Sampling Procedures Manual (NJDEP, 2005).

Each member of the field team will be required to read this document and to fully understand the procedures that will be followed in the field prior to beginning work at OU4. In addition, each field team member will be required to read and understand the applicable sections of the site-wide Site Safety and Health Plan (SSHP; Louis Berger, 2010c) before initiating field activities.

Throughout the course of the field activities, field conditions may differ from those expected. As a result, it may be necessary to change some of the procedures described in this FSP. The Project Team Project Quality Control Officer (QCO) and/or Field Team Leader (FTL) will advise the Technical Project Manager (TPM) of the need to modify procedures. If major changes to this FSP are warranted, they will be documented on the Field Modification Form provided as Attachment 5 to the Quality Assurance Project Plan (QAPP; Louis Berger, 2010b) and provided to the USEPA and USACE for their review and approval. Copies of this FSP and Field Modification Forms (when approved) will be maintained at the field office during the field work.

1.2. Project Background

The former CDE facility is located at 333 Hamilton Boulevard, South Plainfield, Middlesex County, New Jersey. The Site has been divided into four Operable Units by the USEPA. Operable Unit 1 (OU1) addresses residential, commercial, and municipal properties in the vicinity of the former CDE facility. The USEPA signed a Record of Decision (ROD) to address OU1 in September 2003. Operable Unit 2 (OU2) addresses contaminated soils and buildings at the former CDE facility. The USEPA also signed a ROD to address OU2 in September 2004. Operable Unit 3 (OU3) addresses contaminated groundwater, and OU4 addresses the contaminated sediment, floodplain soil, and surface water of Bound Brook. To date, no RODs have been signed for OU3 or OU4. Additional information on the physical characteristics of Bound Brook is provided in

Section 2.1 of the Remedial Investigation Work Plan for OU4 (RIWP; Louis Berger, 2010a).

The former CDE facility, also known as the Hamilton Industrial Park, consists of approximately 26 acres. CDE manufactured electronic components including, in particular, capacitors from 1936 to 1962. Polychlorinated biphenyls (PCBs) and chlorinated organic solvents were used in the manufacturing process. It is believed that CDE disposed of PCB-contaminated materials and other hazardous substances directly on the facility soils. These activities evidently led to widespread chemical contamination at the former CDE facility, as well as migration of contaminants to areas nearby. Elevated levels of volatile organic chemicals (VOCs), PCBs, and other contaminants have been reported in soils at the former CDE facility, in soils at adjacent properties (residential, commercial, and municipal), in groundwater beneath the former CDE facility, and in the surface water and sediments of Bound Brook. Summaries of previous investigations are presented in Section 2.2.3 of the RIWP (Louis Berger, 2010a). A topographic map showing the location of the former CDE facility is included as Figure 1, and the OU4 investigation area is shown on Figure 2.

2. SCOPE AND OBJECTIVES

2.1. Remedial Investigation Objectives

The RI objectives were developed based on the following guidance documents:

- Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA (USEPA, 1988b).
- Contaminated Sediment Remediation Guidance for Hazardous Waste Sites (USEPA, 2005).

The objective of this RI is to fully characterize contaminant distribution and associated potential risk within OU4. The data collection activities listed below will be conducted in support of this objective:

- Aerial and land surveying and mapping.
- Geophysical surveys.
- Sediment geotechnical core collection, processing, and analysis.
- High resolution sediment core collection, processing, and analysis.
- Low resolution sediment core collection, processing, and analysis.
- Floodplain soil boring collection, processing, and analysis.
- Hydrodynamic surveys
- Porewater sample collection (if supported by hydrodynamic survey data).
- Surface water column sample collection, processing, and analysis.
- Sediment trap sample collection, processing, and analysis.
- Surface sediment and soil sample collection, processing, and analysis (for risk assessment purposes).

- Habitat characterization.

A detailed description of the project objectives is presented in the RIWP (Louis Berger, 2010a).

2.2. Conceptual Site Model

An initial preliminary Conceptual Site Model (CSM) was prepared by others for OU4 (TetraTech, 2006). The CSM examined the sources of contaminants, routes of environmental transport, contaminated media, routes of exposure, and receptors. A Conceptual Site Exposure Model (CSEM) is provided in Section 3.3 of the RIWP (Louis Berger, 2010a). Data gathered during the activities described in this FSP will be used to update the CSEM, ultimately providing the basis to adapt and adjust field data collection and to describe the fate and transport of contaminants within OU4.

2.3. Quality Assurance/Quality Control

This FSP was developed to address data collection necessary to complete the RI at OU4. The collection of this data supports the Data Quality Objectives (DQOs) provided in Attachment 1.1 to the QAPP (Louis Berger, 2010b).

The data generated during field activities and by the laboratory must be carefully collected and analyzed. The field methods and sampling procedures described in this FSP are based on established protocols published by the USACE and USEPA (USACE, 2001; USEPA, 1987). The Quality Assurance/Quality Control (QA/QC) portions of the FSP and QAPP were prepared in accordance with the following documentation:

- USEPA Requirements for Quality Assurance Project Plans, USEPA QA\R-5, March 2001

- USEPA Guidance for the Data Quality Objectives Process, QA/G-4, February 2006, and Uniform Federal Policy for Quality Assurance Project Plans, Final Version March 2005.

The QAPP describes the policy, organization, functional activities, and QA/QC protocols necessary to achieve the DQOs dictated by the intended use of the data. The QAPP provides detailed procedures for each QC-related field activity including:

- Site-specific standard operating procedures (SOPs) for sample management, sample preservation, and Technical System Field Audits.
- Chain of custody procedures.
- Sample packaging and shipment procedures.
- Decontamination procedures.
- QA/QC of field sampling and procedures for field changes and corrective action.
- Responsibilities of personnel.
- Parameters to be analyzed, analytical methods, and required analytical sensitivity.

The QAPP presents information regarding DQOs, detection limits, preservation techniques, laboratory testing protocols, and laboratory accuracy and precision goals. It also provides details on the proposed analytical program, including QA/QC samples such as field duplicates and field equipment rinsate blanks. The QAPP also presents information on data validation.

Quality control procedures will be employed to ensure that sample collection procedures, sample transportation, and laboratory activities do not bias sample quality. Trip blanks, field blanks, duplicate samples, matrix spike samples, and matrix spike duplicate samples will provide a quantitative basis for validating the analytical data. A summary of the anticipated QA/QC samples for the RI investigation is provided in Worksheet Nos. 20 and 28 of the QAPP (Louis Berger, 2010b).

2.4. Subcontractors

The following is a list of services to be subcontracted to complete the described investigation activities:

- A surveying subcontract for the locations of Bound Brook cross-sections and sampling transects.
- An aerial surveying subcontract for the mapping of OU4, as necessary.
- A geophysical and vibracoring subcontract for the New Market Pond SSS survey, bathymetric survey, probing, geotechnical coring, and high and low resolution sediment coring.
- A geophysical subcontract for utility mark-out
- A drilling subcontract(s) for direct push and/or hollow stem auger soil sampling in the flood plain and in the areas of buried capacitor debris proximal to OU2.
- A laboratory subcontract for non-CLP (non-Contract Laboratory Program) analytical services.

- A waste disposal subcontract to remove all investigation-derived wastes (IDW, both solid and liquid) generated during the RI.

- A subcontract for data validation services for validation of non-CLP data.

3. GENERAL FIELD REQUIREMENTS

3.1. Site Facilities, Mobilization, and Demobilization

It is anticipated that mobilization of field equipment and supplies will be accomplished on a rolling basis that takes into account the phased approach of the field investigation. A total of three phases of work are planned for the OU4 RI:

- Phase 1: Land surveying to locate probing and geotechnical sediment core transects, geophysical and geotechnical surveys, and initial hydrodynamic data collection via field geology and stream flow surveys.

- Phase 2: High resolution core collection and continuation of hydrodynamic data collection via installation of water level meters and transducers.

- Phase 3: Land surveying (to locate samples and to determine Bound Brook cross-sections), low resolution sediment core collection, floodplain boring collection, continuation of hydrodynamic data collection, surface water sample collection, sediment trap sampling, surface sediment and soil sampling to support the risk assessment, surface sediment and soil sampling for habitat characterization, and cultural resources survey. Optional tasks that could be conducted during Phase 3 of the RI include porewater sampling, geomorphic assessment of selected areas in Bound Brook, and measurement of groundwater elevation.

- Aerial mapping is designated as an optional task and is not currently scheduled in a particular phase of field work.

All equipment and documentation that will be used during the OU4 RI field activities will be stored at a field office. Location of the field office will be coordinated with the USACE (KCD and NYD) and USEPA. Because of the anticipated ongoing OU2 remedial activities during the OU4 field investigation, the Project Team will be in close coordination with the USACE for all activities to be performed within OU2.

All government property purchased for the field investigation will be managed in accordance with Standard Operating Procedure (SOP) No. 05: Government Property Procedures, included in QAPP Appendix B.

Equipment demobilization will also be conducted on a rolling basis, as the phased activities are completed and the materials are no longer needed in the field. Breakdown of the field office will be performed when all field activities are deemed complete by the Project Team, USACE, and USEPA project managers.

3.2. Property Access

Access to the Bound Brook, its tributaries, and to the floodplain will be necessary to perform the RI field investigations. Expected access points to Bound Brook are located at the former CDE facility, at the confluence of Bound Brook and Green Brook, at the boat launch and public park located at New Market Pond (Town of Piscataway), and at the public park at Spring Lake (Borough of South Plainfield). All contact with municipal authorities for access will either be deferred to or coordinated through USEPA.

It is expected that access to public and private property will be required to perform floodplain sample collection. At this time, it is anticipated that USEPA will obtain access to all properties that need to be entered for the investigation activities. The Louis Berger Group, Inc. (Louis Berger) will coordinate with USEPA and USACE to provide all necessary information to facilitate the access agreement process. Should it be determined that Louis Berger is to obtain access, the approach outlined below will be implemented.

All affected property owners will be mailed a request for access letter, with an attached property access permission form. Two attempts will be made to contact a property owner by telephone (if a phone number can be obtained) if no response to the mailing is received after 30 days. After verbal contact, a second access letter may be mailed out if required by the property owner or at the discretion of the USEPA. Visits to properties will be made on up to two occasions, if owners have not responded to the mailing and telephone access attempts. The property visits will be attempted in order to obtain a signed property access form and to record/answer any questions and concerns the owner may have.

Access to any particular property will not be initiated until a signed copy of the access agreement form for that property has been received by the USEPA. Upon receipt of a signed access agreement, affected owners will be contacted by telephone approximately one week in advance of field activities to schedule the date of the proposed access. Once a date and time are agreed upon, a confirmation letter will be sent to the owner citing the relevant information. Property contacts will be limited to owners, unless requested by the owner to contact a tenant to schedule appointments. The field crew will obtain a copy of the signed access form so that it can be presented upon accessing a property.

3.3. Health and Safety

All RI field tasks will be conducted in accordance with the SSHP (Louis Berger, 2010c), prepared in accordance with the Occupational Safety and Health Administration (OSHA) requirements contained in 29 Code of Federal Regulations (CFR) 1910, including the final rule contained in 29 CFR 1910.120. The procedures are also consistent with the guidance contained in the following documents:

- Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities. Prepared jointly by the National Institute for Occupational Safety and Health (NIOSH), OSHA, the U.S. Coast Guard (USCG), and the USEPA (NIOSH, 1985).

- Safety and Health Requirements Manual, Engineering Manual. USACE EM- 385-1-1 (USACE, 2008).

3.4. Standard Operating Procedures for Sample Collection

The methods that will be used during the RI field investigation are captured in the SOPs listed in Table 3-1, below. All sample collection SOPs are provided in Appendix B to the QAPP (Louis Berger, 2010b).

Table 3-1:
Sample Collection and Processing Procedures

Procedure Number	Title
SOP No. 01	Procedure to Conduct Sample Management for CLP and Non-CLP Samples
SOP No. 02	Procedure to Conduct Sample Preservation
SOP No. 03	Procedure to Conduct a Technical System Field Audit
SOP No. 04	Procedure for Collection of Equipment Blanks
SOP No. 05	Government Property Procedures
SOP No. 06	Procedure to Locate Sample Points Using a Global Positioning System (GPS)
SOP No. 07	Sediment Probing
SOP No. 08	Procedure to Collect Push and Piston Cores
SOP No. 09	Vibracore Collection
SOP No. 10	Classification of Soil and Sediment
SOP No. 11	High Resolution Core Processing
SOP No. 12	Procedure for Collection of VOC Samples Using an EnCore™ Sampler
SOP No. 13	Low Resolution Core Processing
SOP No. 14	Collection and Processing of Direct Push Soil Borings
SOP No. 15	Collection and Processing of Hollow-Stem Auger Soil Borings
SOP No. 16	Procedure for the Calibration and Operation of a PID
SOP No. 17	Procedure for the Calibration and Operation of a Horiba U-10
SOP No. 18	Procedure for the Operation of an Oakton pH11 Meter
SOP No. 19	Collection and Processing of Water Samples Using Pump Techniques
SOP No. 20	Collection and Processing of Sediment Trap Samples
SOP No. 21	Collection and Processing of Surface Sediments
SOP No. 22	Collection and Processing of Surface Soils
SOP No. 23	Habitat Characterization
SOP No. 24	Decontamination of Sediment and Soil Sampling Equipment
SOP No. 25	Decontamination of Water Sampling Equipment
SOP No. 26	Management and Disposal of Investigative-Derived Waste
SOP No. 27	Standard Operating Procedure for Streamflow Measurement

4. TASK STATUS

This section summarizes the tasks completed to date and those that will be performed to fulfill the data needs outlined in the DQOs, provided in Attachment 1.1 to the QAPP.

4.1. Summary of Tasks Completed

Data generated from historical soil, sediment, and surface water sample collection activities were assessed to characterize contaminant distribution within Bound Brook and the 100-year floodplain. This assessment guided the development and planning of future tasks, and were integral to updating the CSM. A summary of these historical tasks and additional data analysis tasks are presented in Section 2 and 3 of the RIWP (Louis Berger, 2010a).

As indicated in Section 3.1, the field activities planned for this RI will be implemented in phases, with the data from the first phase used in design of the second, and the results of the second phase guiding particular aspects of the third. The three phases and their specific elements are described in the sections that follow.

4.2. Phase 1 RI Tasks

Specific tasks for Phase 1 include:

- Land surveys to locate probing and geotechnical core transects.
- Geophysical surveys within New Market Pond.
- Geotechnical survey (*e.g.,* probing and core collection).

- Initial hydrodynamic surveys, including field geology and stream flow surveys.
- Processing and analysis geophysical, and geotechnical data.
- Review of final geophysical, and geotechnical data.
- Selection of high resolution core collection locations.
- Processing and analysis of hydrodynamic survey data.

Implementation of the geophysical surveys, geotechnical coring/probing, and hydrodynamic data collection are discussed in Sections 5 and 9, respectively, of this FSP.

4.3. Phase 2 RI Tasks

Specific tasks for Phase 2 include:

- High resolution sediment core collection and processing.
- Continuation of hydrodynamic data collection through installation of water level meters.
- Analysis of radionuclide profiles and selection of high resolution core intervals for chemical analysis.
- Refinement of the analytical suite that will be used in low resolution coring and floodplain boring collection programs based on parameters detected in the high resolution cores.
- Processing and analysis of additional hydrodynamic survey data.

Implementation of the high resolution core collection work and associated data analysis and usage and hydrodynamic data collection are discussed in Sections 6 and 9, respectively, of this FSP.

4.4. Phase 3 RI Tasks

Specific tasks for Phase 3 include:

- Land surveying to define sample locations.
- Low resolution sediment core collection and processing.
- Floodplain soil boring collection and processing.
- Additional hydrodynamic surveys.
- Water column sample collection
- Sediment trap deployment and sample collection.
- Surface sediment and soil sample collection and processing associated with the risk assessment.
- Habitat Characterization.
- Cultural resources surveys.

Implementation of these investigations is described in Sections 5, and 7 through 13 of this FSP, and in the Cultural Resources Work Plan (Louis Berger, 2010d).

5. AERIAL, GEOPHYSICAL, AND GEOTECHNICAL SURVEYS

Land surveys, geophysical surveys, geotechnical survey, and an aerial survey will be performed at OU4 to characterize the physical attributes of Bound Brook, including topography, features, elevations, sediment type and texture, and soil type and texture. Geophysical surveys and geotechnical probing and coring will be conducted during Phase 1 of the RI, and land surveys will be performed during Phases 1 and 3 of the RI. The assumptions used to calculate sample/probe totals are presented in Table 1. Aerial surveys are an optional task, and are not currently scheduled for a specific phase of the RI.

5.1. Land Survey

Land surveys will be conducted to map cross-sections of the Bound Brook, locate sampling points, and to gain an understanding of constraints for portions of OU4 not already characterized by existing data and the aerial survey. Specific elevations that will be obtained during the survey include values for stream bed, bank, and floodplain.

Approximately 40 cross-section transects placed at 1,000-foot intervals along Bound Brook will be surveyed during the investigation. The spacing of planned transects may be adjusted or additional transects added in the field by survey personnel where changes to the brook geomorphology are observed (*e.g.,* the brook narrows or bends) and at confluences with tributaries. Target transect locations are shown on Figures 3 through 6.

Locations for geotechnical and environmental core collection will also be identified during the survey work. These include:

- Sampling transects for geotechnical cores.
- High resolution core locations.
- Sampling transects for low resolution cores and floodplain borings.
- Gridded areas where floodplain borings are planned.
- Ultrasonic water level sensor locations, as part of the hydrodynamic survey.

Sampling transects and grids are shown on Figures 7 through 10.

Surveying activities will be conducted concurrent with associated field investigations during Phases 1 through 3.

Table 5-1 below presents the methods that will be used to implement land surveys. Procedures created by Louis Berger are presented in Appendix B to the QAPP (Louis Berger, 2010b). Procedures that will be developed by the selected subcontractor have not yet been obtained, as the land surveying subcontractor has not yet been selected. These methods will be available once the subcontractor has been chosen.

Table 5-1:
Land Survey Procedures

Activity	Method
Land Survey	Procedure developed by the selected subcontractor and approved by Louis Berger.

5.2. Geophysical Survey of New Market Pond

Geophysical surveys will be performed in New Market Pond using side-scan sonar (SSS) to delineate areas of fine- and coarse-grained sediments, areas of sedimentary bedforms indicative of potential sediment erosion and deposition, and benthic habitat. Water depths throughout the pond will be determined using bathymetric profiling. At this time it is anticipated that single-

beam techniques will be employed by the selected subcontractor to achieve a resolution of +/- 3 inches. Trackline spacing will be determined by the selected subcontractor such that the resolution of the SSS output is approximately one square foot/pixel or finer. The area targeted for SSS and bathymetric profiling is shown on Figure 5.

Sediment probing will be conducted in portions of New Market Pond to help confirm the boundaries of depositional areas delineated during the SSS survey, with probe locations selected based on the texture information shown on the SSS imagery. Probing will also be conducted along SSS tracklines at a frequency to be determined later. Confirmatory cores will be collected at 10% of the probe locations to verify the results of the SSS and probing activities. Each core will be advanced to a depth of two feet or refusal, whichever is encountered first. Confirmatory program details will be finalized based on the findings of the SSS survey. For each probe and core location, the water depth will be recorded and coordinates will be obtained using GPS techniques.

Confirmatory cores will be obtained using vibracoring, push coring, or piston coring techniques, as appropriate. The type of coring technique used will be selected based on the physical characteristics of the sediments and the conditions present in the area being sampled.

Confirmatory cores will be processed longitudinally into 1-foot sections by the selected subcontractor on the survey vessel. Confirmatory sediment samples will be classified in the field using American Society for Testing and Materials (ASTM) and United Soil Classification System (USCS) descriptors. Selected sediment samples will be submitted to an off-site laboratory for physical properties analysis (*e.g.*, grain size, bulk density, Atterberg Limits) and total organic carbon (TOC).

Sample management and preservation will be conducted in accordance with procedures presented in FSP Section 14, Worksheet Nos. 19, 26, and 27 of the QAPP (Louis Berger, 2010b) and in the SOPs specified in Table 5-2, below. Each section will be analyzed for geotechnical parameters as described in Worksheet Nos. 15 and 19 of the QAPP (Louis Berger, 2010b).

All geophysical survey activities will be performed by the selected subcontractor.

Table 5-2 below presents the methods that will be used to implement geophysical investigations in New Market Pond:

Table 5-2:
Geophysical Survey Procedures for New Market Pond

Activity	Method
SSS	Procedure developed by the selected subcontractor and approved by Louis Berger
Bathymetric Profiling	Procedure developed by the selected subcontractor and approved by Louis Berger
GPS Coordinate Collection	SOP No. 06: Procedure to Locate Sample Points Using a GPS
Sediment Probing	SOP No. 07: Sediment Probing
Push or Piston Core Collection	SOP No. 08: Procedure to Collect Push or Piston Cores; or procedure developed by the selected subcontractor and approved by Louis Berger
Vibracore Collection	SOP No. 09: Vibracore Collection
Confirmatory Core Processing	Procedure developed by the selected subcontractor and approved by Louis Berger
Sediment Classification	SOP No. 10: Classification of Soil and Sediment
Sample Management	SOP No. 01: Procedure to Conduct Sample Management for CLP and Non-CLP Samples
Sample Preservation	SOP No. 02: Procedure to Conduct Sample Preservation

Procedures created by Louis Berger are presented in Appendix B to the QAPP (Louis Berger, 2010b). Procedures that will be developed by the selected subcontractor have not yet been developed, as the geophysical subcontractor has not yet been selected. These methods will be available once the subcontractor has been chosen.

5.3. Geotechnical Survey

Sediment geotechnical surveys will be performed from RM 0 to RM 7.5 to characterize the sediment texture and physical properties throughout the Bound Brook corridor.

5.3.1. Sediment Probing

Sediment probing will be conducted using a calibrated steel rod along transects placed at 100-foot intervals between the confluence of Bound Brook and Green Brook and the western boundary of New Market Pond, and between the eastern boundary of New Market Pond and the OU4 boundary with the Wood Brook Road Superfund Site. Two locations will be probed on each transect, and will be spaced at 1/3 and 2/3 of the distance from the southern bank to the northern bank. A total of 360 transects and 720 probing locations are planned.

Probing and transect locations may be moved or additional locations selected based on observations of sediment texture (*e.g.,* when a change in the surface sediment type that is not captured by a planned transect is observed from shore or while wading). Target transect locations are shown on Figures 3 through 6.

Water depth readings will be obtained at each location using either the probe rod or a weighted line marked in 1-inch increments. The coordinates for each probe and core location will be obtained using GPS techniques.

Table 5-3 below presents the methods that will be used to implement the sediment probing portion of the geotechnical investigation. All procedures are included in Appendix B to the QAPP (Louis Berger, 2010b).

Table 5-3:
Sediment Probing Procedures

Activity	Method
GPS Coordinate Collection	SOP No. 06: Procedure to Locate Sample Points Using a GPS
Sediment Probing	SOP No. 07: Sediment Probing

5.3.2. Geotechnical Core Collection, Processing, and Analysis

Geotechnical cores will be collected from a total of 31 transects located every quarter mile from RM 0 to RM 7.5: 28 of these transects are located in the main channel of Bound Brook, and three transects are located within New Market Pond. Two cores will be collected from each of 28 transects located outside of New Market Pond, spaced at 1/3 and 2/3 of the distance from the southern bank to the northern bank, for a total of 56 cores. Three cores will be collected from each of 3 transects located in New Market Pond, one adjacent to each bank, and one from the center, for a total of 9 cores.

Geotechnical core transect locations will be defined during the land survey (Section 5.1), and may be adjusted based on field observation, *e.g.,* a sediment type boundary observed between existing transects. Target geotechnical core transect locations are shown on Figures 3 through 6. If a transect is adjusted in the field, the new location will be measured from the planned location, and the coordinates recorded using GPS techniques.

Each core collection station will be probed prior to core collection to determine the amount and type of material present. Cores will be advanced to refusal; it is expected that core lengths will range from one to six feet in length, depending on the thickness of the sediment column. The coordinates for each core location will be obtained using GPS techniques. The water depth will also be measured at each station at the time of sampling using a weighted line marked in 1-inch increments.

Geotechnical cores will be obtained using vibracoring, push coring, or piston coring techniques, as necessary, to obtain maximum recovery and retrieve representative samples. The type of coring technique used will be selected based on the physical characteristics of the sediments and the conditions present in the area being sampled; at this time it is expected that vibracoring techniques will be utilized in New Market Pond, and push or piston coring methods will be used at all other locations.

Once collected, cores will be kept in a vertical orientation for transport to the field office for processing. Cores will be stored overnight in the upright position to allow fines to settle prior to processing. Once fines have settled, excess water will be drained, cores will be split open longitudinally and described using ASTM and USCS descriptors in continuous, one-foot intervals. If sediment moisture content precludes horizontal core processing, the cores will be processed vertically in segments to accurately describe the stratigraphy. Record samples will be retained at the discretion of the field team leader. Selected sediment samples will be submitted to an off-site laboratory for physical properties analysis (*e.g.*, grain size, bulk density, Atterberg Limits) and TOC.

Sample management and preservation will be conducted in accordance with procedures presented in FSP Section 14, Worksheet Nos. 19, 26, and 27 of the QAPP (Louis Berger, 2010b) and in the SOPs specified in Table 5-4, below. At this time it is estimated that 166 samples will be analyzed for physical parameters as described Worksheet Nos. 15 and 19 of the QAPP (Louis Berger, 2010b).

Table 5-4 below presents the methods that will be used to implement the sediment geotechnical survey at OU4. All procedures are included in Appendix B to the QAPP (Louis Berger, 2010b).

Table 5-4:
Geotechnical Survey Procedures

Activity	Method
GPS Coordinate Collection	SOP No. 06: Procedure to Locate Sample Points Using a GPS
Sediment Probing	SOP No. 07: Sediment Probing
Push or Piston Core Collection	SOP No. 08: Procedure to Collect Push or Piston Cores
Vibracore Collection	SOP No. 09: Vibracore Collection
Sediment Classification	SOP No. 10: Classification of Soil and Sediment
Sample Management	SOP No. 01: Procedure to Conduct Sample Management for CLP and Non-CLP Samples
Sample Preservation	SOP No. 02: Procedure to Conduct Sample Preservation

5.4. Aerial Survey

Aerial surveys are an optional task. If conducted, an aerial survey of OU4 will utilize Digital Ortho Photography to map the local topography and to generate mapping for RI/FS evaluations and presentation of findings. Aerial photographs will be sufficiently accurate to produce 1-foot contours on one inch equals thirty feet (1" = 30') scaled maps.

Table 5-5 below presents the methods that will be used to implement the aerial survey at OU4. Procedures that will be developed by the selected subcontractor have not yet been developed, as the geophysical subcontractor has not yet been selected. These methods will be available once the subcontractor has been chosen.

Table 5-5:
Aerial Survey Procedures

Activity	Method
Aerial Survey	Procedure developed by the selected subcontractor and approved by Louis Berger.

6. HIGH RESOLUTION SEDIMENT CORE COLLECTION

The high resolution coring program will serve to investigate the depositional chronology and associated contaminant distribution at OU4. Data from these cores, describing the nature and extent of more recent and historical inputs of contaminants, will be used to update the conceptual site model (CSM), and will assist in selection of sediment contaminants of potential concern (COPCs) that will be investigated as part of the low resolution coring program (Section 7). High resolution core collection will be performed during Phase 2 of the RI. The assumptions used to calculate sample totals are presented in Table 1.

Evaluation of the deposition chronology will be accomplished through analysis of radionuclide parameters such as beryllium-7 (Be-7) and cesium-137 (Cs-137), both of which can be used to determine when sediment was deposited on the bed of the brook. Be-7 has a half-life of 45 days, making it a useful indicator of recent deposition. Cs-137 was introduced into the environment through the atmospheric testing of nuclear weapons, which was conducted starting in the early 1950s and continued until it was banned in the early 1960s. In cores where the profile of Cs-137 does not show evidence of disturbance, the data user can assign a year of deposition to the depth horizon representing first appearance (1954) and maximum concentration (1963) of this constituent. This information can be used in conjunction with the amount of sediment deposited between those time periods to calculate a point-specific sedimentation rate. This rate can then be used to "date" the remaining horizons of the core, fleshing out a picture of when particular sediments (and their associated contaminants) were deposited at the location.

6.1. High Resolution Core Collection Frequency and Locations

High resolution core locations will be distributed across OU4. The following four areas are proposed for high resolution core collection:

- Near the upstream boundary of OU4 in Bound Brook
- Downstream of and proximal to the former CDE facility in Bound Brook
- Cedar Brook (upstream of Spring Lake)
- New Market Pond

Proposed locations for high resolution cores are shown on Figures 9 and 10.

The proposed locations of high resolution sediment cores were selected based on site reconnaissance and evaluation of historical documentation associated with the site (*e.g.,* description of the history of surface water bodies and historical dredging events). Specific core locations within these areas will be selected based on sediment type and thickness, as determined in the sediment geophysical and geotechnical surveys, and geomorphology (*e.g.,* identification of backwater or sheltered areas). Sites characterized by fine-grained material that show evidence of relatively steady deposition will be given preference. It is expected that sites meeting these criteria may be found in backwaters or protected coves, or in areas blocked by physical structures like bridge abutments. Areas where dredging has been documented (*e.g.,* portions of New Market Pond) will be excluded from consideration.

It is anticipated that four 'datable' high resolution cores from OU4 will be analyzed for chemical parameters (one from each of the areas listed above). It is anticipated that it may be necessary to collect as many three cores from each of the four areas (a total of 12 cores) in order to obtain four 'datable'

cores, those with an undisturbed sediment record. Initial analyses will be performed on all collected cores (up to 12), and will include radionuclides, physical parameters, mercury, and VOCs, as described in Worksheet Nos. 15 and 19 of the QAPP (Louis Berger, 2010b); chemical analysis will be performed as described in Worksheet Nos. 15 and 19 of the QAPP on up to four 'datable' cores selected based on the radionuclide results (Section 6.4).

6.2. High Resolution Core Collection

High resolution core samples will be obtained using vibracoring, push coring, or piston coring techniques, as necessary, to obtain maximum recovery and retrieve representative samples. The type of coring technique used will be selected based on the physical characteristics of the sediments and the conditions present in the area being sampled; at this time it is expected that vibracoring techniques will be utilized in New Market Pond, and push or piston coring methods at all other locations. If the geotechnical investigations conducted during Phase 1 of the RI demonstrate that the depth of unconsolidated sediments in areas outside of New Market Pond exceeds what can be obtained using push or piston coring techniques, portable vibracore technology will be investigated for use in these areas.

Each coring location will be probed prior to core collection to estimate the amount and type of material present. Cores will be advanced to refusal at all locations; it is expected that core lengths will be up to six feet, depending on the thickness of the sediment column. In order to meet analytical volume requirements, the minimum tube/barrel diameter to be used is 4 inches.

The location of each high resolution core will be determined based information obtained during the geophysical and geotechnical surveys (Sections 5.2 and 5.3). If a collection station needs to be adjusted in the field, the location

of the new station will be measured from the planned location, and the new coordinates recorded using GPS techniques. The water depth will also be obtained at each station at the time of collection using a weighted line marked in 1-inch increments.

Once collected, cores will be kept in a vertical orientation for transport to the field office for processing. Cores will be stored at 4°C overnight in the upright position to allow fines to settle prior to processing.

Table 6-1 below presents the procedures that will be used during high resolution core collection. All procedures are included in Appendix B to the QAPP (Louis Berger, 2010b).

Table 6-1:
High Resolution Core Collection Procedures

Activity	Method
GPS Coordinate Collection	SOP No. 06: Procedure to Locate Sample Points Using a GPS
Sediment Probing	SOP No. 07: Sediment Probing
Push or Piston Core Collection	SOP No. 08: Procedure to Collect Push or Piston Cores
Vibracore Collection	SOP No. 09: Vibracore Collection

6.3. High Resolution Core Processing and Radionuclide Analysis

The core segmentation scheme will be based on changes in sediment color or texture observed during processing. Cores will be processed into 20 to 40 sections, depending on length and observed stratigraphy. Ideally, each section will represent one to five years of deposition. Core section size will also be dependent on the analytical volume requirements. Each section will be classified using ASTM and USCS descriptors.

Sub-samples for radionuclides, physical (*e.g.,* total organic carbon), and chemical parameters will be taken from all collected cores (up to 12). Sub-

samples for volatile organic compounds (VOCs) will be collected prior to homogenization using an EnCore™ sampler.

Aliquots for radionuclides, physical parameters, mercury, and VOCs will be submitted for analysis immediately after processing is complete (from up to 12 cores), and those collected for other chemical constituents will be archived (frozen) for analysis at a later date. The process for selecting which cores will be analyzed for chemical constituents is described in Section 6.4.

Sample management and preservation will be conducted in accordance with procedures presented in FSP Section 14, Worksheet Nos. 19, 26, and 27 of the QAPP (Louis Berger, 2010b) and in the SOPs specified in Table 6-2, below. At this time it is estimated that 480 samples will be analyzed for radionuclides, physical parameters, mercury, and VOCs as described Worksheet Nos. 15 and 19 of the QAPP (Louis Berger, 2010b).

Table 6-2 below presents the procedures that will be used during high resolution core processing at OU4. All procedures are included in Appendix B to the QAPP (Louis Berger, 2010b).

Table 6-2:
High Resolution Core Processing Procedures

Activity	Method
Core Processing	SOP No. 11: High Resolution Core Processing
VOC Sample Collection	SOP No. 12: Procedure for Collection of VOC Samples Using an EnCore™ Sampler
Sediment Classification	SOP 10: Classification of Soil and Sediment
Sample Management	SOP 01: Procedure to Conduct Sample Management for CLP and Non-CLP Samples
Sample Preservation	SOP 02: Procedure to Conduct Sample Preservation

6.4. Selection of High Resolution Cores for Chemical Analysis

All samples obtained from all high resolution cores will be initially analyzed for radionuclide parameters, including Be-7 and Cs-137. The Be-7 analysis will be performed on surface samples, only (up to 12 samples), and will characterize sediments that have deposited on the river bottom within the past three months, identifying areas of recent deposition. The Cs-137 analysis will identify two time horizons (1954 and 1963) in the cores, which can then be used to calculate an estimated sedimentation rate.

Ideally, a single high resolution core from each target area that demonstrates no unacceptable discontinuities in the Cs-137 geochronology will be obtained. This core will undergo analysis for the COPCs, as described in Worksheet No. 18 of the QAPP (Louis Berger, 2010b). Data from these cores will be used to evaluate temporal trends in contaminant deposition in the OU4 system, and in the identification of COPCs that will be investigated during the low resolution coring and floodplain soil sampling programs. If none of the high resolution cores in a particular area demonstrate a Cs-137 geochronology that is free of discontinuities, than the core with the least disturbance may still be selected for chemical analysis. The data from these cores will contribute to the identification of COPCs for subsequent sediment and soil investigations and to

the analysis of temporal trends, but it will not be used to draw definitive conclusions regarding depositional history.

If necessary, chemical sample aliquots from the selected cores that were archived for later chemical analysis may be composited based on the radiochemistry data prior to analysis. Sample compositing will be performed by the analytical lab. At this time it is estimated that 80 samples from 'datable' cores will be undergo testing for chemical parameters as described in Worksheet Nos. 19, 26, and 27 of the QAPP (Louis Berger, 2010b).

7. LOW RESOLUTION SEDIMENT CORE COLLECTION

The low resolution sediment coring program will generate data on the nature and extent of contaminated sediments, additional sediment stratigraphic data from visual classification, and support both risk assessment and modeling data needs. Low resolution core collection will be performed during Phase 3 of the RI. The assumptions used to calculate sample totals are presented in Table 1.

7.1. Low Resolution Core Collection Frequency and Locations

The selection of low resolution sediment core locations will consider sediment texture mapping from the geophysical and geotechnical investigations (Sections 5.3 and 5.4), prior sampling conducted by USEPA, and the investigation of tributaries to Bound Brook. Low resolution cores will be collected from 33 transects placed along Bound Brook, the density of which will vary based on proximity to the former CDE facility as follows:

- The distance between transects located between the downstream end of New Market Pond and the confluence with Green Brook ranges from 0.6 to 1 miles;
- The distance between transects located within New Market Pond is approximately 0.1 miles;
- The distance between transects located between the upstream end of New Market Pond and the former CDE facility ranges from 0.2 to 0.4 miles;

- The distance between transects located adjacent to the former CDE facility is approximately 0.05 miles;

- The distance between transects located between the former CDE facility and the Wood Brook Road Landfill Superfund Site ranges from 0.15 to 0.5 miles.

Twenty-six of the 33 transects are located in the main channel of Bound Brook, and the remaining seven are situated in New Market Pond. Two cores will be collected from each transect in the main channel, while three cores will be collected from each transect within New Market Pond. A total of 73 cores will be collected from Bound Brook and New Market Pond.

One transect will be placed at the mouth of each of the three unnamed tributaries to Bound Brook, and at the mouth of the tributary entering New Market Pond from the south at the eastern end. Two low resolution cores will also be collected from each of these transects, bringing the total number of cores for the low resolution program up to 81. Target locations of low resolution core transects are shown on Figures 7 through 10.

7.2. Low Resolution Core Collection

Low resolution core samples will be obtained using vibracoring, push coring, or piston coring techniques, as necessary, to obtain maximum recovery and retrieve representative samples. The type of coring technique used will be selected based on the physical characteristics of the sediments and the conditions present in the area being sampled; at this time it is expected that vibracoring techniques will be utilized in New Market Pond, and push or piston coring methods at all other locations. If the geotechnical investigations conducted during Phase 1 of the RI demonstrate that the depth of unconsolidated sediments in areas outside of New Market Pond exceeds what

can be obtained using push or piston coring techniques, portable vibracore technology will be investigated for use in these areas.

Each location will be probed prior to core collection to estimate the amount and type of material present. Cores will be advanced to refusal at all locations; it is expected that core lengths will range from two to six feet in length, depending on the thickness of the sediment column. The coordinates for each core location will be obtained using GPS techniques and information from the surveyed transects. The water depth will also be measured at each station using a weighted line marked in 1-inch increments.

Once collected, cores will be kept in a vertical orientation for transport to the field office for processing. Cores will be stored at 4^{o}C overnight in the upright position to allow fines to settle prior to processing.

Table 7-1 below presents the procedures that will be followed during low resolution core collection at OU4. All procedures are included in Appendix B to the QAPP (Louis Berger, 2010b).

Table 7-1:
Low Resolution Core Collection Procedures

Activity	Method
GPS Coordinate Collection	SOP No. 06: Procedure to Locate Sample Points Using a GPS
Sediment Probing	SOP No. 07: Sediment Probing
Push or Piston Core Collection	SOP No. 08: Procedure to Collect Push or Piston Cores
Vibracore Collection	SOP No. 09: Vibracore Collection

7.3. Low Resolution Core Processing and Analysis

Low resolution cores will be processed vertically into 6-inch sections, each of which will be classified using ASTM and USCS descriptors. Aliquots for physical and chemical analysis will be collected from each 6-inch section. If sub-

samples for VOC analysis are collected, these aliquots will be obtained prior to homogenization using an EnCore™ sampling device.

Sample management and preservation will be conducted in accordance with procedures presented in FSP Section 14, Worksheet Nos. 19, 26 and 27 of the QAPP (Louis Berger, 2010b), and in the SOPs specified in Table 7-2, below. At this time, it is estimated that a total of 492 samples will be obtained from the low resolution cores, 81 of which will be surface samples.

A subset of the samples need to be analyzed for the full suite of parameters as described in Worksheet Nos. 15 and 19 of the QAPP (Louis Berger, 2010b) to support the baseline human health risk assessment (BHHRA). The BHHRA requires five samples from each of the seven defined exposure units, yielding a total of 35 samples. Details on the BHHRA are presented in Section 5.6.1 of the RIWP (Louis Berger, 2010a).

The remaining 457 samples will be analyzed for total organic carbon (TOC) and for the COPCs identified via evaluation of the high resolution coring results. Fifteen of the 81 surface samples will undergo Acid Volatile Sulfide/Simultaneously Extracted Metal (AVS/SEM) analysis in support of the BHHRA.

Table 7-2 below presents the procedures that will be used during low resolution core processing at OU4. All procedures are included in Appendix B to the QAPP (Louis Berger, 2010b).

Table 7-2:
Low Resolution Core Processing Procedures

Activity	Method
Core Processing	SOP No. 13: Low Resolution Core Processing
VOC Sample Collection	SOP No. 12: Procedure for Collection of VOC Samples Using an EnCore™ Sampler
Sediment Classification	SOP No. 10: Classification of Soil and Sediment
Sample Management	SOP No. 01: Procedure to Conduct Sample Management for CLP and Non-CLP Samples
Sample Preservation	SOP No. 02: Procedure to Conduct Sample Preservation

8. FLOODPLAIN SOIL BORING COLLECTION

The floodplain soil boring program will characterize the vertical and horizontal distribution of contaminants within the upland portion of OU4, and the extent of soil contamination below capacitor debris areas. Floodplain soil borings will be collected during Phase 3 of the RI. The assumptions used to calculate sample totals are presented in Table 1.

8.1. Floodplain Soil Boring Locations

8.1.1. Upland of Bound Brook

A systematic sampling design has been proposed for floodplain soil boring collection. Soil borings will be advanced in the upland portions of 21 of the 33 low resolution core sampling transects crossing Bound Brook. The other seven transects are placed within New Market Pond and do not extend into the floodplain. Soil borings will also be advanced on a regular grid in areas between Fred Allen Drive and the confluence of Bound Brook and Cedar Brook, where elevated PCB concentrations were detected previously. Borings advanced on the floodplain portion of transects will be placed at 100-foot intervals between the edge of Bound Brook and the boundary of the 100-year floodplain, with the first boring drilled five feet from the edge of the water. Grid spacing in the areas between Fred Allen Drive and the confluence of Bound Brook and Cedar Brook will be 200 feet.

Where transects and gridded areas overlap, soil borings will be collected at the grid spacing instead of every 100 feet along the transect. Five of the 26 low resolution sampling transects overlap with gridded areas, reducing the total number of transects with floodplain sampling to 21. A total of 78 borings will be obtained from along transects and 52 from the gridded areas, for a total of 130.

The systematic plan will be impacted by the extent of depositional areas. Boring locations will be biased toward depositional zones, as appropriate. These zones will be identified using any or all of the following methods:

- Review of aerial photographs documenting significant historic flooding events (as available).
- Evaluation of topography and flooding maps.
- Observations of the floodplain and stream banks gathered during land (Section 5.3.3) and stream flow (Section 5.3.10) surveys.
- Anecdotal information from the USACE-NYD or local municipalities.

All requests for information from other agencies or local municipalities will be routed through the USACE-KCD and USEPA for prior approval.

Once depositional areas have been identified, final floodplain boring locations will be selected. Statistical software (*e.g.,* Visual Sampling Plan) may be used in the selection process. These locations will be submitted to the USACE-KCD and USEPA for approval to finalization.

The location of target transects and areas selected for gridded sample collection are shown on Figures 7, 9 and 10.

8.1.2. Additional Floodplain Borings at Green Brook Confluence

Floodplain boring collection on 200-foot grid spacing has also been recommended for the area of the 100-year floodplain located at the confluence of Bound Brook and Green Brook, if the results of water column and sediment

trap sampling in that area suggest that contaminants of concern may be present in the brook or transported in the water column at that location.

8.1.3. Areas of Known Debris Disposal

Soil borings will be collected from areas along Bound Brook proximal to the former CDE facility where test pit investigation conducted by the USEPA in 2008 has revealed the presence of buried capacitor debris. USEPA's test pit program is summarized in Section 2.2.3.6 of the RIWP (Louis Berger, 2010a). Of the eight test pits excavated, numbered 1 through 8, four showed evidence of debris that indicate the presence of capacitor debris in the soil column below the observed debris. A single soil boring will be collected from each of these test pit areas (numbers 1, 2, 6, and 7), for a total of four borings.

8.2. Floodplain Soil Boring Collection

Soil borings collected upland of Bound Brook will be obtained using direct push techniques, and will be advanced to four feet below the ground surface (bgs). Borings collected from known debris areas will be obtained using hollow-stem auger (HSA) techniques, and will be advanced to refusal. Soil collected using both direct push and HSA methods will be processed at the time of collection. The coordinates for all boring locations will be obtained using GPS techniques.

Table 8-1 below presents the procedures that will be used during soil boring collection. All procedures are included in Appendix B to the QAPP (Louis Berger, 2010b).

Table 8-1:
Floodplain Soil Boring Collection Procedures

Activity	Method
GPS Coordinate Collection	SOP No. 06: Procedure to Locate Sample Points Using a GPS
Soil Boring Collection	SOP No. 14: Collection and Processing of Direct Push Soil Borings SOP No. 15: Collection and Processing of Hollow Stem Auger Soil Borings

8.3. Soil Boring Processing and Analysis

Soil borings collected using direct push and HSA techniques will be processed longitudinally into 1-foot sections, each of which will be classified using ASTM and USCS descriptors. Each sample will be scanned with a photo-ionization detector (PID) prior to homogenization. If sub-samples for VOC analysis are collected, these aliquots will be obtained prior to homogenization using an EnCore™ sampling device.

Aliquots for physical and chemical analysis will be collected from each section. The samples obtained from direct push borings will be sent for analysis on the following schedule:

- Samples collected from all depth horizons for physical parameters, VOCs (if collected), and mercury will be sent for analysis immediately.

- Samples obtained for chemical parameters from the 0 to 1- and 1 to 2-foot horizon will be sent for analysis immediately.

- Samples obtained for chemical parameters from the 2 to 3- and 3 to 4-foot layers will be archived (frozen) for future analysis if data from the 1 to 2-foot section suggests the presence of contamination below 2 feet.

All samples obtained from the borings obtained from the capacitor debris area will be sent for physical and chemical analysis immediately after collection.

Sample management and preservation will be conducted in accordance with procedures presented in FSP Section 14, Worksheet Nos. 19, 26, and 27 of the QAPP (Louis Berger, 2010b), and in the SOPs specified in Table 8-2, below. A total of 435 (390 from transects and grids and 45 from debris cores) samples will be obtained during the floodplain investigation. At this time, it is estimated that they will be analyzed as follows:

- Fifteen percent of the 435 samples collected (65 samples) will be analyzed for physical parameters as described in Worksheet Nos. 15 and 19 of the QAPP (Louis Berger, 2010b). This total includes samples collected in the transect and gridded areas, and those collected from the capacitor debris areas.

- The chemical aliquots from all 45 samples collected from the cores advanced in debris areas will be analyzed as described in Worksheet Nos. 15 and 19 of the QAPP (Louis Berger, 2010b).

- The chemical aliquots for twenty five of the 390 samples collected from transects and on grids, distributed among the five exposure units defined for the BHHRA, will be analyzed for the full suite of parameters as described in Worksheet Nos. 15 and 19 of the QAPP (Louis Berger, 2010b) to satisfy the data needs of the BHHRA. Details on the BHHRA are presented in Section 5.6.1 of the RIWP (Louis Berger, 2010a).

- The chemical aliquots from the remaining 365 samples will be analyzed for COPCs identified via evaluation of the high resolution coring results. This total includes all of the samples collected from the 0 to 2 foot layer, and ¼ of the samples collected from the 2 to 4 foot layer.

Table 8-2 below presents the procedures that will be used during low resolution core processing. All procedures are included in Appendix B to the QAPP (Louis Berger, 2010b).

Table 8-2:
Floodplain Boring Processing Procedures

Activity	Method
Soil Processing	SOP No. 14: Collection and Processing of Direct Push Soil Borings SOP No. 15: Collection and Processing of Hollow Stem Auger Soil Borings
VOC Sample Collection	SOP No. 12: Procedure for Collection of VOC Samples Using an EnCore™ Sampler
PID Operation	SOP No. 16: Procedure for the Calibration and Operation of a Photoionization Detector
Soil Classification	SOP No. 10: Classification of Soil and Sediment
Sample Management	SOP No. 01: Procedure to Conduct Sample Management for CLP and Non-CLP Samples
Sample Preservation	SOP No. 02: Procedure to Conduct Sample Preservation

9. HYDRODYNAMIC SURVEYS

Hydrodynamic data collection, including field geology and stream flow surveys, collection of water quality parameter values, and continuous water level measurements will be conducted throughout OU4. The information gathered will be used to evaluate groundwater discharge into Bound Brook, select surface water sampling locations, and calibrate hydrodynamic and sediment transport models. Hydrodynamic data collection will be conducted during all three phases of the RI.

9.1. Field Geology and Stream Flow Survey

A field geology survey will be conducted to visually identify outcrops and fracture zones that indicate the discharge of groundwater to Bound Brook. Observed potential sources of groundwater to the Brook will be photographed and a description and the location recorded in a field log. The field geology survey will be conducted during Phase 1.

A stream flow survey will be conducted to identify potential areas of groundwater contribution to Bound Brook. Stream flow measurements will be collected during a low-flow period on transects spaced approximately every 0.25 miles. Flow will also be measured/estimated in each tributary and flowing outfall, as possible. Outfalls observed during the stream flow survey will be photographed, and their dimension, location, and any other notable information logged in a field notebook. Water quality data, including dissolved oxygen, temperature, conductivity, turbidity, and salinity will also be collected at each transect. The coordinates for each flow measurement and set of water quality parameter data will be obtained using GPS techniques.

Table 9-1 below presents the procedures that will be used to implement the hydrodynamic survey at OU4. All procedures are included in Appendix B to the QAPP (Louis Berger, 2010b).

Table 9-1:
Hydrodynamic Survey Procedures

Activity	Method
GPS Coordinate Collection	SOP No. 06: Procedure to Locate Sample Points Using a GPS
Water Quality Parameter Collection	SOP No. 17: Procedure for the Calibration and Operation of a Houriba U-10 SOP No. 18: Procedure for the Operation of an Oakton pH11 Meter
Stream Flow Measurement	SOP No. 27: SOP for Streamflow Measurement

9.2. Hydrodynamic Data Collection

To evaluate the transport of contaminated sediment in Bound Brook and to calibrate numerical models, data must be gathered on Bound Brook's discharge under base flow and storm conditions. Flow stage will be monitored continuously using ultrasonic water level sensors placed at the along the main channel of Bound Brook selected during the stream flow survey (Section 9.1), and by transducers installed at the outlets of Spring Lake and New Market Pond.

Flow stage data will be captured by a data logger, which will be downloaded periodically. The ultrasonic water level meters will be installed during Phase 2 of the RI, and will be left in place for approximately one year. The coordinates for meter will be obtained using GPS techniques. Flow stage data will be used in combination with cross-section survey data to determine discharge.

10. SURFACE WATER SAMPLE COLLECTION

Water column sampling will be conducted throughout OU4 to estimate dissolved and particle concentrations of the COPCs. Results of the investigation will define the COPC concentrations to be evaluated during the human health and ecological risk assessments, identify the nature and extent of COPC source areas to support remedial alternative development and evaluation, and ultimately support the development, calibration, and evaluation of fate and transport models, as needed. Water column sampling results obtained near the confluence of Bound Brook and Green Brook will also be used to determine if floodplain soil borings should be advanced in the proximal Green Brook 100-year floodplain area as shown in the Optional Investigation Area on Figures 7 and 8. The assumptions used to calculate sample totals are presented in Table 1.

The COPCs in the Bound Brook system can be categorized into two general groups:

- Hydrophobic organic compounds (HOCs), including dioxins, TCL pesticides, PCBs, and TCL VOCs and SVOCs.
- Organometals including TAL metals.

In addition to these COPCs, several conventional and hydrodynamic parameters are needed to support fate and transport analysis and risk assessment. These conventional and hydrodynamic parameters include: total suspended solids (TSS), dissolved organic carbon (DOC), TOC, turbidity, temperature, water depth, and conductivity.

Understanding fate and transport and the geochemical behavior of contamination at OU4 requires an evaluation of the partitioning of contaminants between the dissolved and particulate phases. Hence, the surface water sampling program will emphasize the collection of both dissolved phase and particulate phase COPCs. These data will support fate and transport model development and evaluations required to update the geochemical components of the conceptual site model.

10.1. Surface Water Sampling Frequency and Locations

Surface water monitoring will be conducted during Phase 3 of the RI sampling program, and will include collection of large and standard volume surface water samples which represent base flow events. Surface water sampling locations will be finalized after the results of the stream flow survey (Section 9.1) have been evaluated, though it is anticipated that one of the stations will be located near the confluence of Bound Brook and Green Brook, to determine if soil sampling should be conducted in the proximal Green Brook 100-year floodplain area (shown on Figures 7 and 8). Surface water sample locations will be discussed in more detail in an addendum to this FSP.

Two sampling events will be conducted at the selected stations during Phase 3 of the RI. Both events will be performed under base flow conditions. Each sampling event will ultimately yield three types of analytical samples for each station: total phase (whole water) analysis, filtered particulate analysis, and dissolved phase analysis. The particulate phase and dissolved phase contaminant loads are needed to support fate and transport evaluations and numerical model calibration. Total phase (whole water) and dissolved phase results are needed for comparison to risk assessment criteria.

10.2. Surface Water Sample Collection

The first round of water samples will be collected using pump techniques. It is expected that the water depth at the sampling locations will not be deep enough to require the use of depth-integrated sampling techniques. Water samples will be collected from a depth corresponding to 50% of the water column depth.

At this time it is planned that large volume water samples (25L) will be collected for hydrophobic contaminants (including but not limited to PCB congener and dioxin analysis), and that standard volume water samples will be collected for all other parameters, as described in Worksheet No. 19 to the QAPP (Louis Berger, 2010b).

If analysis of the first set of samples indicates that the 25L volume is insufficient to meet the project action levels for hydrophobic contaminants (including but not limited to PCB congener and dioxin analysis; provided in Worksheet No. 15 of the QAPP [Louis Berger, 2010b]) at any of the monitoring stations, the collection method will be adjusted for collection of the second round of samples. At this time, it is anticipated that a trace organic platform sampler (TOPS) will be selected as the alternate procedure. An addendum to this FSP will be issued describing the procedures associated with the TOPS at that time.

Water quality parameters including temperature, turbidity, dissolved oxygen, pH, conductivity, and redox potential will be measured at each location using a Horiba U-10 and an Oakton pH 11 Meter. The water depth at each station will be determined using a weighted line marked in 1-inch increments. The coordinates for each water sampling station will be obtained using GPS techniques.

Table 10-1, below presents the procedures that will be used during water sample collection. All procedures are included in Appendix B to the QAPP (Louis Berger, 2010b).

Table 10-1:
Water Sample Collection Procedures

Activity	Method
GPS Coordinate Collection	SOP No. 06: Procedure to Locate Sample Points Using a GPS
Water Quality Parameter Collection	SOP No. 17: Procedure for the Calibration and Operation of a Houriba U-10 SOP No. 18: Procedure for the Operation of an Oakton pH11 Meter
Water Sample Collection	SOP No. 19: Collection of Water Samples Using Pump Techniques

10.3. Surface Water Sample Processing and Analysis

Whole water, filtered particulate, and filtered water samples will be submitted to for analysis. Water may be filtered in the field using a TOPS or Infiltrex™ device to produce filtered solids and dissolved phase aliquots for analysis. Alternately, filtering to obtain the particulate and dissolved phase fractions will be performed at the analytical laboratory.

Sample management and preservation will be conducted in accordance with procedures presented in FSP Section 14, Worksheet Nos. 19, 26, and 27 of the QAPP (Louis Berger, 2010b), and in Table 9-2, below. Samples will be analyzed for chemical constituents as described in Worksheet Nos. 15 and 19 of the QAPP (Louis Berger, 2010b).

Table 10-2 below presents the procedures that will be used during surface water sample processing and management. All procedures are included in Appendix B to the QAPP (Louis Berger, 2010b).

Table 10-2:
Surface Water Sample Processing and Management Procedures

Activity	Method
Water Sample Processing	SOP No. 19: Collection and Processing of Water Samples Using Pump Techniques
Sample Management	SOP No. 01: Procedure to Conduct Sample Management for CLP and Non-CLP Samples
Sample Preservation	SOP No. 02: Procedure to Conduct Sample Preservation

11. SEDIMENT TRAP SAMPLE COLLECTION

Sediment trap sampling will be performed to establish a baseline understanding of the fate and transport of sediments within OU4 and further the understanding of particle-associated contaminant transport. Results of the investigation will provide information on the flux of sediment through Bound Brook, into Bound Brook from the tributaries, and out of Bound Brook. The data obtained will ultimately support the development, calibration, and evaluation of fate and transport models. The assumptions used to calculate sample totals are presented in Table 1.

Sediment traps gradually collect particles being transported in the water column as flow passes over the traps. They are typically deployed for two to four weeks, and it is anticipated that sediment will be obtained during base flow and storm flow conditions during that time. Upon retrieval, the collected sediment is removed from the trap and submitted for laboratory analysis. The analytical results provide an integrated characterization of sediment transport during the period of deployment, reducing the uncertainty associated with the collection of water column grab samples during storm events.

11.1. Sediment Trap Design and Construction

Different sediment trap designs have been used to determine vertical fluxes in marine settings, including flat plates, domed bottles, jars, plastic bags, funnels, and horizontal slit cylinders. Of these, horizontal slit cylinders with a length to diameter ratio greater than or equal to three are the best option for OU4 sampling.

Each sediment trap will be constructed of six tubes, each of which will be 24 inches long and have an inner diameter of approximately 3 inches. A slot will be cut along the longitudinal axis of each tube that extends from end to end, with spacers two inches in length left approximately every foot to prevent the tube from collapsing inward. The tubes will be securely attached to a lattice support structure, with the slitted sides facing upward into the water column. A photograph of a sediment trap is included in SOP 20: Collection of Sediment Trap Samples.

11.2. Sediment Trap Locations and Deployment

Two sediment traps will be placed at each sampling location. Currently planned locations include the three unnamed tributaries to Bound Brook and Cedar Brook, which enters Bound Brook just downstream of the former CDE facility. It is anticipated that a pair of sediment traps may also be installed at all or a subset of the surface water sampling locations selected based on the results of the stream flow survey (Section 9.1).

Tributary traps will be positioned just upstream of the tributary confluence with the Bound Brook main channel and New Market Pond. The water depth at each sediment trap location will be determined using a weighted line marked in 1-inch increments. The coordinates for each sediment trap location will be obtained using GPS techniques. The above-listed sediment trap locations are shown on Figure 9. Additional sediment trap locations will be discussed in more detail in an addendum to this FSP.

It is anticipated that traps will remain installed under conditions of base flow and storm flow. Sediment traps will be staked directly to the river bottom and be attached to a safety line that is staked to the shore to prevent loss of the trap during the high flows that are common in Bound Brook during storm

events. The lattice will also be anchored down with weights wherever possible. Each trap will be inspected regularly until sufficient volume to meet analytical requirements has accumulated. At this time, it is anticipated that sediment traps will be installed for a 2-4 week deployment during Phase 3; the actual deployment period will be dependent on sediment collection volume as required for chemical analysis.

Table 11-1, below presents the procedures that will be used during sediment trap sample collection. All procedures are included in Appendix B to the QAPP (Louis Berger, 2010b).

Table 11-1:
Sediment Trap Sampling Procedures

Activity	Method
GPS Coordinate Collection	SOP No. 06: Procedure to Locate Sample Points Using a GPS
Sediment Trap Sample Collection	SOP No. 20: Collection and Processing of Sediment Trap Samples

11.3. Sediment Trap Retrieval and Sample Processing and Analysis

Once the traps have collected enough sediment to meet analytical volume requirements, the devices will be removed from the installation point and moved to an on-shore work area. The traps will be kept positioned with the tube slits upward at all times to avoid loss of sample material.

Once onshore, the sediment collected in each tube from both traps will be placed into a separate, pre-cleaned container. All material collected in each tube will be combined and homogenized to form a representative composite. Samples for other chemical and physical analysis will be taken from the representative composite.

Sample processing, management and preservation will be conducted in accordance with procedures presented in FSP Section 14, in Worksheet Nos. 19,

26, and 27 of the QAPP (Louis Berger, 2010b), and in the SOPs specified in Table 10-2, below. Analysis parameters for the sediment trap samples will be prioritized in case insufficient sediment mass is retrieved, and the solids collected in the traps analyzed following this hierarchy. The amount of mass obtained will determine how many constituents will be analyzed - if a low sediment mass is collected by the trap only some of the desired parameters will be analyzed. At this time it is estimated that 9 samples will undergo chemical analysis. All analyses will be conducted in accordance with Worksheet Nos. 15 and 19 of the QAPP (Louis Berger, 2010b).

Table 11-2 below presents the procedures that will be used during sediment trap processing and management. All procedures are included in Appendix B to the QAPP (Louis Berger, 2010b).

Table 11-2:
Sediment Trap Sample Processing and Management

Activity	Method
Sediment Trap Sample Processing	SOP No. 20: Collection and Processing of Sediment Trap Samples
VOC Sample Collection	SOP No. 12: Procedure for Collection of VOC Samples Using an EnCore™ Sampler
Sample Management	SOP No. 01: Procedure to Conduct Sample Management for CLP and Non-CLP Samples
Sample Preservation	SOP No. 02: Procedure to Conduct Sample Preservation

12. SEDIMENT AND SOIL GRAB SAMPLING

Sediment toxicity tests (both short-term to measure acute effects and long-term to measure sub-lethal effects) and sediment and floodplain soil bioaccumulation tests will be conducted to support the ecological risk assessment (ERA) and the BHHRA. . The testing will be conducted at a subcontract laboratory using sediment and floodplain soil collected from OU4 locations.

The objectives of the biological testing program include:

- Assessing the effects of exposure to contaminants in sediment to representative invertebrate species.

- Determining the bioavailability of PCBs in sediment and floodplain soil and uptake into representative aquatic and terrestrial invertebrates to support food web modeling and hazard evaluation for higher trophic level organisms identified as ecological receptors of concern.

Sediment and soil grab samples will also be collected from selected reference sites both within and outside OU4 to serve as control samples for the toxicity and bioaccumulation testing and to obtain background concentration information for each COPC and COPEC. The biological lab selected to perform the toxicity and bioaccumulation tests will submit aliquots of each grab sample to the CLP laboratories for analysis of PCB Congeners, Target Analyte List (TAL), and Target Compound List (TCL) constituents.

The assumptions used to calculate sample totals are presented in Table 1.

12.1. Sediment and Soil Grab Sample Collection for Toxicity and Bioaccumulation Testing

The toxicity tests and bioaccumulation tests will be performed on floodplain soil and/or sediment samples collected as described below, and will be conducted for PCB congeners. Before initiating the tests, sub-samples of laboratory test specimens for toxicity and bioaccumulation tests will undergo chemical analysis to determine background levels, if any. Sub-samples of laboratory test specimens for the sediment and floodplain soil bioaccumulation tests will be analyzed for PCB Congeners, and sub-samples of laboratory test specimens for the sediment toxicity tests will be analyzed for PCB Congeners, TAL, and TCL constituents.

All test specimens, both before and after testing, will be depurated for 24 hours before collection for chemical analysis.

The following sediment toxicity tests will be conducted:

- 10-Day survival and growth test with the amphipod *Hyalella azteca* (Test Method 100.1).
- 10-Day survival and growth test with the chironomid *Chironomus tentans* (Test Method 100.2).
- 42-Day survival, growth, and reproduction test with *Hyalella azteca* (Test Method 100.4.
- Life-cycle test with *Chironomus tentans* (Method 100.5).

Sediment bioaccumulation tests with the aquatic oligochaete *Lumbriculus variegatus* will be conducted following the methodology presented in the USEPA's Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates (USEPA, 2000; Test Method 100.3). Floodplain soil bioaccumulation tests with an appropriate terrestrial earthworm species (to be determined) will be conducted following the methodology presented in ASTM International's Standard Guide for Conducting Laboratory Soil Toxicity or Bioaccumulation Tests with the Lumbricid Earthworm *Eisenia fetida* and the Enchytraeid Potworm *Enchytraeus albidus* (ASTM International, 2004; E 1676-04).

12.1.1. Sediment Sample Locations, Collection and Processing

Sediment samples for the toxicity tests and the bioaccumulation tests will be collected at the following five locations:

- In Bound Brook, opposite the former CDE facility.
- A location in Bound Brook (to be determined based on the results of the geophysical survey) between the former CDE facility and New Market Pond.
- A location in the deeper part of New Market Pond.
- A location in Bound Brook (to be determined based on the results of the geophysical survey) downstream of New Market Pond .
- Two or more reference sites (exact location to be determined based on similarity in land use to Bound Brook) selected based on similarity to New Market Pond (an impoundment) and Bound Brook.

The coordinates for all sampling locations will be obtained using GPS techniques and confirmed via land surveying, and the water depth will be measured at each station using a weighted line marked in 1-inch increments.

If sediment samples for the biological testing are collected at the same time as sediment samples for chemical analysis, care must be taken to not collect them from a location physically disturbed by the collection of the samples for chemical analysis. It is anticipated that approximately 12 L of sediment (based on TOC content) representing the top 3 to 4 inches of material will be collected from each sediment sampling location. Sediment samples will be classified using ASTM and USCS descriptors. The sediment samples should be used in the bioaccumulation tests as soon as possible, but generally within eight weeks of collection.

Table 12-1, below, presents the procedures that will be used to collect and process sediment grab samples for bioaccumulation testing. All procedures are included in Appendix B to the QAPP (Louis Berger, 2010b).

Table 12-1:
Sediment Bioaccumulation Grab Sample Collection and Processing Procedures

Activity	Method
GPS Coordinate Collection	SOP No. 06: Procedure to Locate Sample Points Using a GPS
Sediment Sample Collection	SOP No. 21: Collection and Processing of Surface Sediments
Soil Classification	SOP No. 10: Classification of Soil and Sediment
Sample Management	SOP No. 01: Procedure to Conduct Sample Management for CLP and Non-CLP Samples
Sample Preservation	SOP No. 02: Procedure to Conduct Sample Preservation

12.1.2. Floodplain Soil Sample Locations, Collection, and Processing

Floodplain soil samples for the terrestrial earthworm bioaccumulation tests will be collected at the following four locations:

- The location along the Bound Brook corridor with the highest PCB concentrations based on review of the existing floodplain soil data.
- Two locations along the Bound Brook corridor to be determined based on review of preliminary PCB data for floodplain soil samples collected during the RI.
- A reference site (exact location to be determined).

The coordinates for all sampling locations will be obtained using GPS techniques with survey confirmation. In order to have sufficient material to conduct the earthworm bioaccumulation tests, it is anticipated that 24 liters of soil will be collected at each location using a box corer or similar device. Soil samples will be classified using ASTM and USCS descriptors. The floodplain soil samples should be used in the bioaccumulation tests as soon as possible, but generally within eight weeks of collection.

Table 12-2, below, presents the procedures that will be used to collect and process sediment grab samples for bioaccumulation testing. All procedures are included in Appendix B to the QAPP (Louis Berger, 2010b).

Table 12-2:
Soil Bioaccumulation Grab Sample Collection and Processing Procedures

Activity	Method
GPS Coordinate Collection	SOP No. 06: Procedure to Locate Sample Points Using a GPS
Soil Sample Collection	SOP No. 22: Collection and Processing of Surface Soils
Soil Classification	SOP No. 10: Classification of Soil and Sediment
Sample Management	SOP No. 01: Procedure to Conduct Sample Management for CLP and Non-CLP Samples
Sample Preservation	SOP No. 02: Procedure to Conduct Sample Preservation

12.2. Sediment and Soil Grab Sampling at Reference Sites

Sediment and soil sampling will be performed at the selected reference sites (selection process described in Section 13) for use in the risk assessment process.

Ten surface sediment samples and 10 surface soil grab samples will be collected at each of the selected reference sites. The sediment and soil collected will represent the top 3 to 4 inches of material. The locations of all sediment and soil grab samples will be obtained using GPS techniques. The water depth at all sediment grab sample locations will be obtained using a weighted line marked in 1-inch increments.

Aliquots for VOC analysis will be collected immediately after collection. Once the VOC sub-sample has been obtained, the material will be classified using ASTM and USCS descriptions. Samples will then be thoroughly mixed, and aliquots for the remaining chemical analysis collected from the homogenized material.

Sample management and preservation will be conducted in accordance with procedures presented in FSP Section 14, Worksheet Nos. 19, 26, and 27 of the QAPP (Louis Berger, 2010b), and in the SOPs specified in Table 12-3, below. At this time it is estimated that 20 samples (10 sediment and 10 soil) will be

analyzed for physical and chemical parameters as described in Worksheet Nos. 15 and 19 of the QAPP (Louis Berger, 2010b). Only sediment samples will undergo AVS/SEM analysis.

Table 12-3 below presents the procedures that will be used during sediment and soil grab sampling. All procedures are included in Appendix B to the QAPP (Louis Berger, 2010b).

Table 12-3:
Sediment and Soil Sampling and Processing Procedures

Activity	Method
GPS Coordinate Collection	SOP No. 06: Procedure to Locate Sample Points Using a GPS
Sediment Sample Collection	SOP No. 21: Collection and Processing of Surface Sediments
Soil Sample Collection	SOP No. 22: Collection and Processing of Surface Soils
Soil Classification	SOP No. 10: Classification of Soil and Sediment
Sample Management	SOP No. 01: Procedure to Conduct Sample Management for CLP and Non-CLP Samples
Sample Preservation	SOP No. 02: Procedure to Conduct Sample Preservation

13. HABITAT CHARACTERIZATION

Much of the habitat within OU4 has been well characterized, with the most comprehensive work conducted during the 1999 Ecological Evaluation (USEPA, 1999). Since then, a wildlife species investigation (Stantec, 2008) within and upstream of OU4 and a habitat assessment (Malcolm Pirnie, 2008) in OU2 have been conducted. Therefore, habitat characterization will be conducted within OU4 and one or more potential reference locations outside of OU4 to:

- Document current conditions.
- Document changes in habitats previously characterized.
- Characterize habitat in areas not previously characterized.
- Confirm the selection of receptors for the risk assessment.

This information, together with surface water, sediment, and floodplain soil, and toxicity and bioaccumulation test results will be used to assess potential adverse effects resulting from the selected COPECs.

13.1. Habitat Characterization Activities at OU4

Areas at OU4 where habitat has previously been characterized will be visited, to the extent they are accessible, to document the current conditions and any changes that have occurred since the last investigation.

Habitat characterization conducted in areas not previously investigated will focus on characterization of the following:

- The dominant vegetation within each habitat.
- Community structure.
- Wildlife utilization.

- Sensitive resources (*e.g.,* surface waters, wetlands, and threatened and endangered habitat).

Potential aquatic and terrestrial habitat will be determined from available aerial photographs and mapping (*e.g.*, National Wetland Inventory [NWI]) prior to going into the field and identified as polygons on maps/figures developed for use in the field. The identified polygons will be investigated in the field, to the extent they are accessible, to determine key habitat features.

Information to be collected on key habitat features for aquatic habitat will include:

- Bank erosion (or the potential for erosion).
- Percent of vegetation overhanging the bank.
- Amount of protection vegetation affords to the bank and the near-stream portion of the riparian zone.
- Water depth and clarity and bottom conditions (*e.g.*, sediment type, hard bottom).
- Presence of submerged aquatic vegetation including species present and relative abundance.
- Relative quantity and variety of natural structures in the brook, as well as its impoundments and tributaries, such as cobble (riffles), large rocks, fallen trees, logs and branches, and undercut banks, available as refugia, feeding sites, or sites for spawning and nursery functions of aquatic macrofauna.
- Percent cover (logs, boulders, cavities, brush, debris, or standing timber) during summer within pools, backwater areas, and littoral areas.

Information to be collected on key habitat features for terrestrial habitat will include:

- Composition of the tree (overstory) layer, scrub/shrub layer, and herbaceous vegetation layer including dominant species in each stratum.
- Cover type (*e.g.*, woodland, grassland).

Fish and wildlife observed during the habitat characterization will also be recorded, and the following will be noted:

- Approximate number of individuals observed.
- Species utilization of habitat (*i.e.*, foraging, nesting, *etc.*).
- Species utilization of vegetation stratum (*i.e.*, submerged aquatic vegetation, open field, shrub/scrub, forested).

In addition, available data from the New Jersey Division of Fish and Wildlife Endangered and Nongame Species Program and other federal or local agencies will be used to identify possible habitat for documented threatened or endangered species that may utilize habitat within OU4.

Habitat characterization activities at OU4 will be conducted in accordance with SOP No. 23: Habitat Characterization, included in Appendix B to the QAPP (Louis Berger, 2010b).

13.2. Habitat Characterization Activities at Reference Sites

Areas that meet the following criteria based on the 2002 NJDEP land use/land cover data (NJDEP, 2002) and NJDEP and NWI wetlands mapping have been preliminarily identified for further investigation as potential reference locations:

- Within close proximity to, but outside of, OU4.
- Drain mostly residential and some commercial/industrial areas and wetlands.

Potential reference locations for impoundments within OU4 (New Market Pond) include Cedar Brook Lake on Cedar Brook and/or Lake Nelson on Ambrose Brook. The following sites within those areas have been identified for investigation for potential reference locations for brook sediment/floodplain soil within OU4:

- Area A - Bound Brook and some of its tributaries upstream of OU4.
- Area B - Cedar Brook upstream of OU4 and possibly upstream of Cedar Brook Lake.
- Area C - Green Brook upstream of the optional 100-year floodplain boundary.

Potential reference areas, both within and outside of OU4 are shown on Figure 11.

Potential reference locations will be investigated for physical and biological characteristics within the water bodies and floodplains that are similar to those observed within the water bodies and floodplains of OU4. To determine the most suitable reference location(s), various physical and biological characteristics will be evaluated and considered during the RI field investigation, including:

- Stream morphology
- Water depth
- Temperature
- pH

- Sediment particle size distribution
- Redox characteristics and organic matter content.
- Habitat structure
- Relative species abundance, richness, and diversity.

The water depth (where applicable) will be measured using a weighted line marked in 1-inch increments. Five grab samples representing the 0 to 6-inch horizon will be collected from each potential reference area to investigate particle size distribution and organic matter content. Each grab sample will be classified using ASTM and USCS descriptors. The location of all collected physical measurements and samples will be obtained using GPS techniques or surveyed.

Sample management and preservation will be conducted in accordance with procedures presented in FSP Section 14, Worksheet Nos. 19, 26, and 27 of the QAPP (Louis Berger, 2010b), and in the SOPs specified in Table 13-1, below.

Table 13-1 below presents the procedures that will be used during habitat characterization at potential reference sites All procedures are included in Appendix B to the QAPP (Louis Berger, 2010b).

Table 13-1:
Habitat Characterization Procedures

Activity	Method
Habitat Characterization	SOP No. 23: Habitat Characterization
GPS Coordinate Collection	SOP No. 06: Procedure to Locate Sample Points Using a GPS
Water Quality Parameter Collection	SOP No. 17: Procedure for the Calibration and Operation of a Houriba U-10 SOP No. 18: Procedure for the Operation of an Oakton pH11 Meter
Sediment Sample Collection/Processing	SOP No. 21: Collection and Processing of Surface Sediments
Soil Sample Collection/Processing	SOP No. 22: Collection and Processing of Surface Soils
Soil Classification	SOP No. 10: Classification of Soil and Sediment
Sample Management	SOP No. 01: Procedure to Conduct Sample Management for CLP and Non-CLP Samples
Sample Preservation	SOP No. 02: Procedure to Conduct Sample Preservation

14. FIELD OPERATIONS DOCUMENTATION AND SAMPLE HANDLING

14.1. Field Logbook and Calibration Log

The following information will be recorded in the field notebook or on a calibration log at the time of sampling:

- Sample or measurement designation
- Sample or measurement target coordinates (as applicable)
- Sample or measurement actual coordinates
- Name of field sampler
- Method of collection
- Time and date of measurement/sampling
- Type of measurement/sample
- Depth/location of measurement/sample
- Analyses required and sample container type (as applicable)
- Field measurements and calibration (as applicable)
- Locations where photographs are taken (as applicable)
- Observations and remarks

A blank instrument calibration log is included in Attachment 1 to this FSP and will be used to record instrument calibration readings. Instruments used during the OU4 investigation will be calibrated and operated in accordance with the following procedures. All procedures are included in Appendix B to the QAPP (Louis Berger, 2010b).

Table 14-1:
Instrument Calibration Procedures

Instrument	Method
Photoionization Detector	SOP No. 16: Procedure for the Calibration and Operation of a Photoionization Detector
Horiba U-10	SOP No. 17: Procedure for the Calibration of a Horiba U-10
Oakton pH 11 Meter	SOP No. 18: Procedure for the Operation of an Oakton pH11 Meter

A bound field log book will be maintained for recording the daily activities. All entries will be made in indelible ink. Incorrect entries will be corrected by a single stroke through the error and will be verified with the recorder's initials. Entries to the log book, in addition to the required sampling entries will include:

- Date
- Start and finish times
- Summary of work performed (including samples or measurements collected)
- Sequential number and description of photographs
- Names of personnel present
- Personal protective equipment (PPE) used
- Names of visitors
- Weather
- Calibration of equipment
- Log of drummed waste generated
- Observations and remarks

14.2. Photographic Records

Photographs will be taken throughout the RI field program and arranged into a photo log to visually document the stages of the investigation.

14.3. Sample Documentation

Sample custody during the field investigations will be performed in three phases. The first custody phase encompasses sample collection, pre-laboratory treatment procedures, packaging, and shipping field custody procedures. The second custody phase involves sample shipment, where mode of shipment, airbill numbers, dates and times are documented. The third custody phase involves the custody procedures employed by the laboratory. All three phases of sample custody will be performed in accordance with Worksheet Nos. 26 and 27 of the QAPP (Louis Berger, 2010b) to provide that:

- All samples are uniquely identified
- The correct samples are tested and are traceable to their source
- Important sample characteristics are preserved
- Samples are protected from loss or damage
- A record of sample integrity is established and maintained through the entire custody process

14.3.1. Sample Identification System

All samples collected from the Site must be identified with a sample label in addition to an entry on a chain-of-custody record. Indelible ink will be used to complete sample labels and the chain-of-custody record. In addition, each sample shall be identified by a unique sample number. The sample identification scheme to be used is described in Attachment 2 to this FSP.

14.3.2. Sample Labels/Tags

In accordance with Worksheet No. 26 of the QAPP (Louis Berger, 2010b) sample labels will require the field team to complete the following information for each sample container:

- Site Name
- Sample Number
- Sample Matrix
- Parameters to be analyzed
- Date of Collection
- Time of Collection
- Preservation Technique Employed (if applicable)
- Sampler's Name

14.3.3. Chain of Custody Record

The chain-of-custody (COC) guidelines create an accurate written record that can be used to trace the possession and handling of the sample from the moment of its collection through analysis. COC forms will be completed for each sample at the time of collection and will be maintained while shipping the sample to the laboratory in accordance with Worksheet No. 27 and SOP 01: "Procedure to Conduct Sample Management, both of which are included in the QAPP.

14.4. Sample Management and Preservation

Sample management and preservation will be conducted in accordance with procedures presented in Worksheet Nos. 19, 26, and 27 of the QAPP (Louis Berger, 2010b). It is anticipated that both USEPA CLP laboratories will be used to analyze most or all samples collected at OU4. As such, sample management will comply with procedures developed in accordance with methods presented

in the Contract Laboratory Program Guidance for Field Samplers (USEPA, 2007). Sample management and preservation will be conducted in accordance with SOP No. 01: Procedure to Conduct Sample Management for CLP and Non-CLP Samples and SOP No. 02: Procedure to Conduct Sample Preservation. All procedures are included in Appendix B to the QAPP (Louis Berger, 2010b).

15. DECONTAMINATION AND INVESTIGATIVE-DERIVED WASTE

15.1. Equipment Decontamination

Non-dedicated sample collection and processing equipment will be decontaminated on-site in accordance with SOP No. 24: Decontamination of Sediment and Soil Sampling Equipment and SOP No. 25: Decontamination of Water Sampling Equipment SOPs are included in QAPP Appendix B (Louis Berger, 2010b).

15.2. Investigative-Derived Waste

It is anticipated that disposable PPE, consumable sampling equipment (*e.g.,* used sediment core tubes) and spent decontamination fluids will be generated during the field investigation.

Decontamination fluids, sediments, and soils will be separately containerized in Department of Transportation (DOT) approved 55-gallon steel drums. Weather-resistant labels will identify drum contents and origin including the date of drum filling, type of materials and possible contaminants.

Every attempt will be made to remove gross surface contamination so that PPE (*e.g.,* Tyvek suits, gloves, and other disposable items) and consumable sampling equipment may be disposed of in the normal domestic waste stream. If contamination is suspected, these materials will be drummed in the same fashion as excess sediment and soils.

Drummed materials will be staged at in a designated location to be approved by USACE and USEPA. Drums will be securely sealed (*i.e.,* capped and banded). Louis Berger will maintain a log of the drums and drum contents. The

USACE and the USEPA will be notified regarding the contents of each drum. Louis Berger will have the drum contents evaluated following the completion of the field investigation and will inform the USACE to determine and arrange for appropriate disposal. All handling, transport and disposal of these materials will be in accordance with requirements mandated by the Resource Conservation and Recovery Act (RCRA), Toxic Substance Control Act (TSCA), and other applicable federal, state, and local regulations.

Non-hazardous disposable items will be contained and disposed of in a dumpster or via a licensed waste hauler, as appropriate.

Specific procedures for management of investigative-derived waste are presented in SOP No. 26: Management and Disposal of Investigative-Derived Waste. SOPs are included in QAPP Appendix B (Louis Berger, 2010b).

16. REFERENCES

The Louis Berger Group, Inc., 2010a. Final Remedial Investigation/Feasibility Study Work Plan Operable Unit 4: Bound Brook. Cornell-Dubilier Electronics Superfund Site, South Plainfield, NJ. Prepared by The Louis Berger Group, Inc. and Malcolm Pirnie, Inc.

The Louis Berger Group, Inc., 2010b. Final Quality Assurance Project Plan OU4 Bound Brook. Cornell-Dubilier Electronics Superfund Site, South Plainfield, NJ. Prepared by The Louis Berger Group, Inc. and Malcolm Pirnie, Inc.

The Louis Berger Group, Inc., 2010c. Attachment D to the Final Site-Wide Site Safety and Health Plan for All Operable Units (OU1 through OU4) Cornell-Dubilier Electronics Superfund Site, South Plainfield, NJ. Prepared by The Louis Berger Group, Inc. and Malcolm Pirnie, Inc.

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17. GLOSSARY OF ABBREVIATIONS

ANSETS	Analytical Services Tracking System
AOC	Administrative Order on Consent
ARARs	Applicable or Relevant and Appropriate Requirements
ASTM	American Society for Testing and Materials
AVS/SEM	Acid Volatile Sulfide/Simultaneously Extracted Methods
Be-7	Beryllium-7
BHHRA	Baseline Human Health Risk Assessment
BGS	Below Ground Surface
CDE	Cornell-Dubilier Electronics
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CERCLIS	Comprehensive Environmental Response, Compensation and Liability Information System
CFR	Code of Federal Regulation
CLP	Contract Laboratory Program
COPC	Chemical of Potential Concern
COPEC	Chemical of Potential Ecological Concern
CESM	Conceptual Site Exposure Model
CSM	Conceptual Site Model
DOC	Dissolved Organic Carbon
DQO	Data Quality Objectives
ERA	Ecological Risk Assessment
FS	Feasibility Study
FSP	Field Sampling Plan
GPS	Global Positioning System
HAS	Hollow Stem Auger
HOC	Hydrophobic Organic Compound

IDW	Investigation Derived Waste
KCD	Kansas City District
NIOSH	National Institute of Occupational Safety and Health
NJDEP	New Jersey Department of Environmental Protection
NWI	National Wetland Inventory
NYD	New York District
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
OU1	Operable Unit 1
OU2	Operable Unit 2
OU3	Operable Unit 3
OU4	Operable Unit 4
PCB	Polychlorinated Biphenyl
PID	Photoionization Detector
PM	Project Manager
PPE	Personal Protective Equipment
QA/QC	Quality Assurance / Quality Control
QAPP	Quality Assurance Project Plan
QCO	Quality Control Officer
QCP	Quality Control Plan
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RI/FS	Remedial Investigation / Feasibility Study
RIWP	Remedial Action Work Plan
ROD	Record of Decision
RPM	Remedial Project Manager
SOPs	Standard Operating Procedures
SSHP	Site-Specific Safety and Health Plan
SSS	Side Scan Sonar

SVOC	Semi-Volatile Organic Compound
TAL	Target Analyte List
TCL	Target Compound List
TOC	Total Organic Carbon
TOPS	Trace Organics Platform Sampler
TPM	Technical Project Manager
TSCA	Toxic Substance Control Act
TSS	Total Suspended Solids
USCG	United States Coast Guard
VOC	Volatile Organic Compound
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USCS	United Soil Classification System